इंटरनेट मानक

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IS 14257 (1995): Lead-acid storage batteries for motor vehicles with light weight and high cranking performance [ETD 11: Secondary Cells and Batteries]

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मोटर वाहनों के लिए सीसा-अम्ल की हल्के भार वाली और उच्च क्रैंकिंग कार्यकारिता से युक्त भंडारण बैटरियाँ — विशिष्टि

Indian Standard

LEAD-ACID STORAGE BATTERIES FOR MOTOR VEHICLES WITH LIGHT WEIGHT AND HIGH CRANKING PERFORMANCE — SPECIFICATION

(First Reprint APRIL 1999)

UDC 621·355·2 : 622·113 : 620·16

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

July 1995 Price Group 6

Secondary Cells and Batteries Sectional Committee, ETD 11

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Secondary Cells and Batteries Sectional Committee had been approved by the Electrotechnical Division Council.

With the latest development in the field of manufacturing of batteries for these motor-vehicles having high engine compression ratios and fuel efficiency that require high cranking current, need was felt to standardize such batteries in a separate standard. This standard covers batteries designed for higher cranking performance in relation to their low rated capacities and weights. These batteries are popularly known as starter batteries.

In line with current uses and practical relevance, batteries covered in this part have been rated at the 5 h rate only, a notional 20 h capacity has been added in the reference purpose only.

In the preparation of this standard, assistance has been derived from the following:

a) IEC Pub 95-1 (1988) Lead-acid starter batteries, Part 1 General requirements and methods of test. International Electrotechnical Commission.

b) JIS D5 301 : 1988 Lead acid batteries for automobiles. Japanese Standards Association.

c) DIN 43 539, Part 2 1983 Starter batteries for starting, lighting and ignition; test methods. Deutsches Institut für Normung.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

AMENDMENT NO. 1 JULY 2003
TO
IS 14257 : 1995 LEAD-ACID STORAGE BATTERIES FOR MOTOR VEHICLES WITH LIGHT WEIGHT AND HIGH CRANKING PERFORMANCE — SPECIFICATION

[*Page* 2, *clause* **8.1**(d)] — Insert the following at the end:

e) Symbol for 'lead recycle'; and

f) Symbol for 'Don't dispose off'.

(ET 11)

Reprography Unit, BIS, New Delhi, India

Indian Standard

LEAD ACID STORAGE BATTERIES FOR MOTOR VEHICLES WITH LIGHT WEIGHT AND HIGH CRANKING PERFORMANCE — SPECIFICATION

1 SCOPE

This standard covers characteristics, dimensions and tests for light weight lead acid storage batteries with a rated voltage of 12 volts to be used as power for starting and meeting the other electrical load of vehicles driven by internal combustion engines.

2 REFERENCES

The standards listed in Annex A are necessary adjuncts to this standard.

3 TERMINOLOGY

3.0 For the purpose of this standard, the definitions given in IS 1885 (Part 8) : 1986 in addition to the following shall apply.

3.1 Type Tests

Tests carried out to prove conformity with the requirements given in a standard. These are intended to prove the general quality and design of a given type of battery.

3.2 Acceptance Tests

Tests carried out on samples selected from a lot for the purpose of verifying the acceptability of the lot.

3.3 Dry Charged Batteries

A battery intended for use as soon as it has been filled with electrolyte, without any initial charging or alternatively with additional activation charging according to manufacturer's recommendations.

4 MATERIALS, CONSTRUCTION AND WORKMANSHIP

4.0 General Construction

The battery consists of six elements connected in series and housed in a plastic monobloc container. Each element consists of positive plates, negative plates and separators. The lid shall be of one piece construction sealed to the container by heat sealing or ultrasonic sealing or by adhesion with sealing material, with one positive and one negative terminal.

4.1 Container and Lid

The container and lid shall be of plastic, such as polypropylene, ABS, etc, conforming to IS 1146 : 1981.

4.2 Separator

Separators shall be leaf or envelope type, with or without glass mat conforming to IS 6071 : 1986.

4.3 Sealing Material

Sealing material employed shall be an acid resistant adhesive, wherever the sealing is not effected by heat sealing or by ultrasonic welding.

4.4 Terminals

The terminals shall be made of lead alloys and shall conform in shape and dimensions to Fig. 1 and Table 1.

Table 1 Dimensions of Tapered Terminals

(*Clauses* 4.4 *and* 9.3.10)

Terminal Type	Dimensions of *D* (mm)		Types
	(+)	(-)	
(1)	(2)	(3)	(4)
Small	$14.7^{+0}_{-0.3}$	$13.0^{+0}_{-0.3}$	INS 40/INT 60/INS 60
Standard	$19.5^{+0}_{-0.3}$	$17.9^{+0}_{-0.3}$	IN 50 INS 120 IN 50Z IN 120 IN 70 INT 200 IN 70Z IN 150 IN 100 IN 180 IN 200

NOTE — Tolerance on *D* may be taken as ±0.03 mm at present.

4.5 Electrolyte

The sulphuric acid and water used for the preparation and maintenance of electrolyte shall conform to IS 266 : 1977 and IS 1069 : 1964 respectively.

4.6 Specific Gravity

For the purpose of the tests, with the battery fully charged and the electrolyte level corresponding to the upper level marked on the battery, a specific gravity of 1.280 ± 0.01 (corrected to 27°C) shall be used.

The temperature correction shall be made by the following formula:

$$SG_{27} = SG_t + 0.000\,7\,(t - 27)$$

where

SG_{27} = specific gravity at 27°C,

SG_t = specific gravity at t°C, and

t = temperature of electrolyte at the time of measurement, °C.

5 RATING

High performance storage batteries shall be rated at the 5-h rate and the ratings shall be chosen from Table 2.

The 5-h rating is the ampere-hour obtainable when the battery is discharged at a constant current I = 0.2 C5 amperes down to a final terminal voltage of 10.50 V, the capacity being corrected to an electrolyte temperature of 27°C (*see* **9.3.4.1**).

6 CAPACITIES, DIMENSIONS, MASS AND LAYOUT

Capacities, overall dimensions and mass (with electrolyte of 1.280 ± 0.01 specific gravity at 27°C) shall conform to Table 2.

The layout of the battery and polarity of the terminals shall conform to either Fig. 2 or Fig. 3 as indicated in Table 2.

7 CHARGING

7.1 The initial and normal charging of batteries shall be done in accordance with the manufacturer's instructions.

7.2 Fully Charged Battery

A battery is deemed to be fully charged when the terminal voltage and specific gravity of electrolyte (corrected for temperature) measured every 30 minutes towards end of charging at the recommended current shows a constant value 3 times consecutively.

8 MARKING

8.1 The following information shall be marked on the battery at easily visible places:

a) Indication of source of manufacture;
b) Type;
c) Country of manufacture; and
d) Month and year of manufacture or their code.

8.1.1 The batteries may also be marked with the Standard Mark.

8.1.2 The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

9 TESTS

9.1 Classification of Tests

9.1.1 *Type Tests*

The tests given in **9.1.1.1** constitute the type tests.

9.1.1.1 *Sequence of tests*

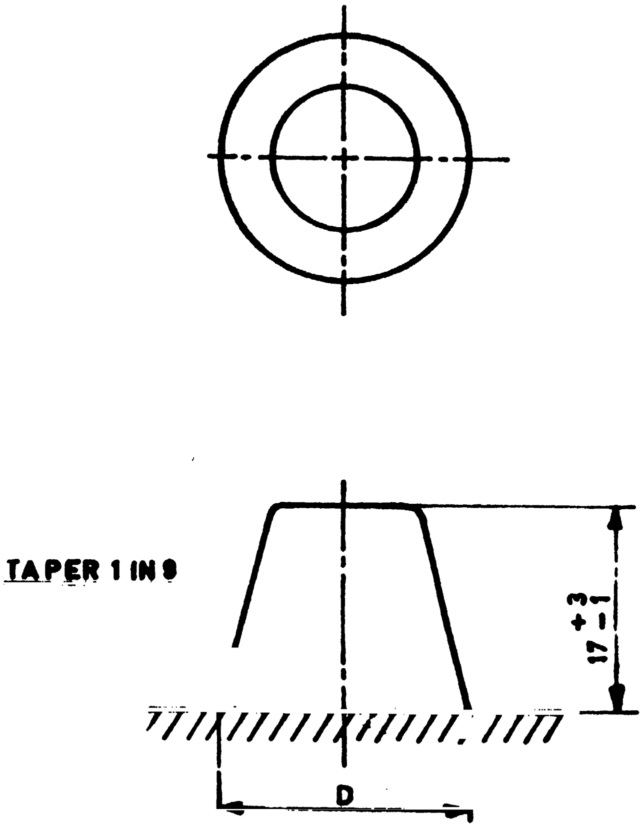
Five samples shall be drawn at random and tested in accordance with the schedule given below:

	Tests	*Battery Number*				
		1	2	3	4	5
a)	Physical examination (*see* 3)	X	X	X	X	X
b)	Dimensions and layout	X	X	X	X	X
c)	Marking	X	X	X	X	X
d)	Charge acceptance	—	—	—	—	X
e)	5-h capacity	X	X	X	X	X
f)	High rate at −15°C	X	X	X	X	—
g)	Life cycle test	X	X	—	—	—
h)	Overcharge endurance	—	—	X	X	—
j)	Vibration test	—	—	—	—	X
k)	Strength of terminal	—	—	—	—	X
m)	Robustness to fastening	—	—	—	—	X

NOTES

1 If any sample fails in the relevant type test the testing authority may call for fresh samples not exceeding twice the original number and subject them again to the tests in which failure occurred. If there is any failure in the retests the type shall be considered as not having passed the requirements.

2 In addition to the tests listed under **9.1.1.1**, some special tests as given in Annex B may also be conducted in the event of a special contractual agreement between the manufacturer and the customer.



All dimensions in millimetres.
FIG. 1 TAPERED TERMINAL

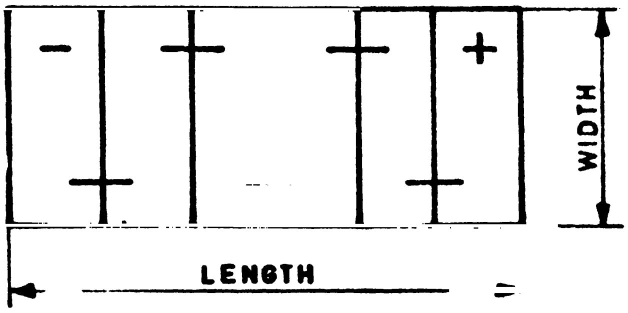


FIG. 2 BATTERY LAYOUT

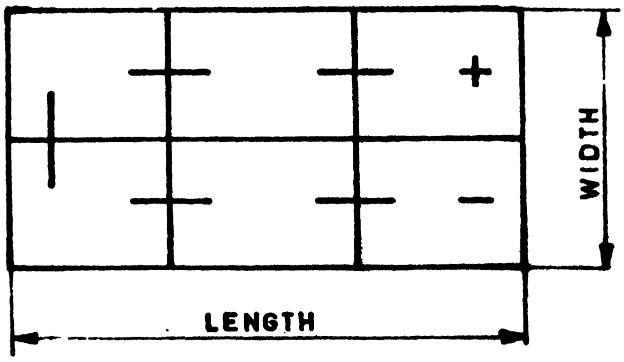


FIG. 3 BATTERY LAYOUT

9.1.2 *Acceptance Tests*

The following shall constitute the acceptance tests:

a) Physical examination,
b) Dimensions and layout,
c) Marking,
d) 5-h capacity, and
e) High rate discharge test at −15°C.

9.1.3 *Sampling Scheme and Criteria for Acceptance*

A recommended sampling scheme and criteria for the acceptance of lots for various lot sizes is given in Annex C.

9.2 Equipment

9.2.1 *Voltmeter and Ammeter*

The voltmeter and ammeter used shall be of an accuracy class not inferior to 0.5 in accordance with IS 1248 (Part 2) : 1983.

9.2.2 *Thermometer*

A thermometer with an appropriate scale shall be used for measuring temperature and one division of graduated scale shall represent at the most 1°C. The accuracy of the calibration shall be not less than 0.5°C.

9.2.3 *Hydrometer*

The specific gravity of the electrolyte shall be measured by a hydrometer provided with a graduated scale, one division of which shall represent at the most 0.005 unit of specific gravity. The accuracy of calibration shall be not less than 0.005 unit of specific gravity.

9.2.4 *Instrument for Measuring Length*

For measuring overall dimensions, a calliper or metal ruler shall be used of an accuracy not inferior to 0.5 mm.

9.3 Methods of Test and Requirements

9.3.1 *Physical Examination*

The batteries shall be checked for conformity with the requirements of 4 for type tests.

For acceptance tests the batteries shall be checked for conformance to 4.0 and 4.4 only.

Table 2 Capacities, Overall Dimensions and Mass

(*Clauses* 5 *and* 6)

Battery Type	Capacity 5-h Rate	Maximum Overall Dimensions, mm			Battery Height	Mass with Electrolyte	Layout	Reference 20-h Rate Capacity
		Length	Width	Container Height				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
INS 40	25.6	197	129	203	227	11	2	32
INT 60	28	197	129	203	227	11.5	2	35
INS 60	36	238	129	203	227	14.5	2	45
IN 50	40	260	173	204	225	16.5	2	50
IN 50Z	48	260	173	204	225	18.0	2	60
IN 70	56	306	173	204	225	22.5	2	70
IN 70Z	60	306	173	204	225	24.0	2	75
IN 100	80	410	176	213	233	31.0	2	100
INS 120	88	410	176	213	233	32.5	2	110
IN 120	96	505	182	213	257	36.5	3	120
INT 200	108	505	182	213	257	38.0	3	135
IN 150	120	508	222	213	257	45.0	3	150
IN 180	144	521	278	220	270	61.5	3	180
IN 200	160	521	278	220	270	64.0	3	200

NOTES

1 All are 12 volts batteries.

2 All type/acceptance tests shall be carried out on the basis of discharge at the 5-h rate only. The 20-h capacity is indicated only to establish an equivalence with other test specifications.

3 While the manufacturer can have their own nomenclature, the specific desgination should conform to one of the IS types as listed above.

4 Mass with electrolyte has been indicated for the purpose of reference only.

9.3.2 *Dimensions and Layout*

The dimensions and layout shall be checked for conformance to Table 2.

9.3.3 *Marking*

The batteries shall be checked by visual inspection for conformity with 8.

9.3.4 *Capacity (5-h Rate)*

The 5-h capacity shall be determined by discharging a fully charged battery (*see* 7.1) at a constant current of I = 0.2 C5 amperes to a final terminal voltage of 10.50 V under the following conditions:

a) Time to commence discharge	After fully charged battery has stood an open circuit for 2 to 12 h.
b) Electrolyte level	Between +1 mm to -5 mm from upper level marked on battery.
c) Electrolyte temperature during discharge	20 to 35°C
d) Intervals of recording current, voltage and temperature readings	Every 30 min
e) Intervals of noting electrolyte specific gravity	Before start and on completion of discharge

9.3.4.1 *Temperature correction*

The capacity obtained by multiplying the discharge current in amperes by the discharge duration in hours shall be corrected to the standard reference temperature 27°C as follows:

$$C_{27} = \frac{C_t}{1 + 0.01\,(t - 27)}$$

where

C_{27} = 5-h capacity at an average electrolyte temperature of 27°C,

C_t = 5-h capacity at an average electrolyte temperature t, and

t = mean of initial and final electrolyte temperature in degrees celsius.

9.3.4.2 *Requirement*

Batteries tested shall reach the rated 5-h capacity during the course of the first three cycles after initial charge. Alternatively the battery will be deemed to have passed the capacity test if it meets 95 percent of the rated 5-h capacity in the first discharge.

9.3.5 *High Rate Discharge*

The high rate discharge is tested at -15°C under the following conditions:

a) Before a high rate discharge test, the battery shall be subjected to a 5-h capacity test.

b) The batteries under test shall comply with the conditions given in Table 3.

c) The battery shall be discharged at the current specified against its type in Table 4 down to a terminal voltage of 6.00 V. The terminal voltage shall be taken at 5 to 7 s and at 30 s intervals thereafter.

Table 3 Test Conditions

(*Clause* 9.3.5)

Condition (1)	Requirement (2)
Minimum period the fully charged battery shall stand for stabilization	16 h
Temperature of electrolyte at start of discharge	-15 ± 1°C

9.3.5.1 *Requirement*

The battery shall meet the minimum terminal voltage specified after 5 to 7 s or 30 s respectively and the minimum duration to 6.00 V in Table 4.

NOTE — If the battery fails to reach the values specified in Table 4, two more tests may be carried out up to a total of three high rate discharges.

9.3.6 *Charge Acceptance*

The charge acceptance is tested on a new battery not subjected to any test under the following conditions, and the current value measured after an interval of 10 min from commencement of charging.

a) State of battery before test	The battery is charged in accordance with 7. It is then discharged at the 5-h discharge rate for 2.5 h at an electrolyte temperature of 20 to 35°C. It is then allowed to stand at an ambient temperature of 0 ± 2°C for not less than 12 h
b) Temperature of electrolyte at commencement of charging	0 ± 2°C
c) Charging voltage at battery terminals	14.4 ± 0.1 V

9.3.6.1 *Requirement*

The battery shall meet the minimum requirement in Table 4.

9.3.7 *Life Cycle Test*

The life cycle test is carried out on a battery which has passed the test of 9.3.4 and 9.3.5.

a) Throughout the test and during the checking discharges, the battery shall be kept at an ambient temperature (in a water bath or environmental test chamber) of 40 – 45°C.

Table 4 Electrical Performance

(*Clauses* 9.3.5, 9.3.5.1, 9.3.6.1, 9.3.7.1 *and* 9.3.9.1)

Battery Type	Discharge Current	High Rate Discharge to 6.0 V			No. of Endurance Cycles	Overcharge Endurance Units	Charge Acceptance
		5 to 7 sec Voltage	30 sec Voltage	Duration			
(1)	(2) A	(3) V	(4) V	(5) Min	(6)	(7)	(8)
INS 40	150	8.9	—	2.5	275 (165)	3	3
INT 60	150	9.5	—	3.5	250 (150)	4	3.5
INS 60	300	8.6	—	2.0	300 (180)	6	4.5
IN 50	150	9.0	—	4.0	285 (170)	5	5
IN 50Z	300	7.8	—	1.9	315 (190)	7	6
IN 70	300	—	8.2	2.8	315 (190)	9	7
IN 70Z	300	—	8.7	3.3	375 (225)	10	7.5
IN 100	300	—	8.8	4.0	415 (250)	5	10
INS 120	500	—	8.2	2.6	485 (290)	7	11
IN 120	500	—	8.2	2.6	485 (290)	7	12
INT 200	500	—	9.0	3.3	525 (315)	9	13.5
IN 150	500	—	8.6	3.6	600 (360)	9	15
IN 180	500	—	8.9	4.8	700 (420)	11	18
IN 200	500	—	9.0	5.6	785 (470)	13	20

NOTE — The specific numerical values of endurance cycle will be assigned depending upon the category of battery as indicated below:

Category A — Endurance cycles shown under col 6 without the parenthesis, for example, 315 cycles for IN 50Z battery. Category A batteries are generally assembled with special separators.

Category B — Endurance cycles shown under col 6 within the parenthesis, for example, 190 cycles for IN 50Z battery. Category B batteries are generally assembled with conventional separators.

b) The battery shall be subjected to a series of discharges and charges as in Table 5.

c) During the test, at the 25th, 50th, 75th and every 25th cycle thereafter, a continuous discharge shall be made at the current in Table 5, Sl No. (i) until the terminal voltage drops down to 10.20 V and the duration measured.

d) The test is terminated when the capacity obtained as the product of discharge time (at 40 to 45°C ambient) and the discharge current falls to 50 percent or less of the 5-h capacity in Table 2 and does not increase again.

e) After every checking discharge (c) the battery shall be recharged at the appropriate current in Table 5, Sl No. (ii) until the specific gravity (corrected to 27°C) and terminal voltage is constant for 3 consecutive 30 min readings.

f) Throughout the test, the level of electrolyte shall be maintained at the specified level by topping up with pure water. Topping up should be done during the charging portion of cycles. The battery shall not be topped up immediately before the checking discharges (c).

g) The number of life cycles is determined graphically from a curve of number of cycles (*X* axis) against capacity (*Y* axis).

The number of tests at 5-h rate (9.3.4) and high rate discharge (9.3.5) shall be added to the number of life cycles obtained graphically above.

9.3.7.1 *Requirement*

The battery shall meet the minimum requirements given in Table 4.

9.3.8 *Vibration Resistance*

The resistance to vibration is conducted on a fully charged battery after it has passed a capacity test (9.3.4). The battery is tested under the following conditions:

a) Discharge current during vibration = 0.2 C5 amperes,
b) Direction of vibration = vertical simple harmonic motion,
c) Peak to peak amplitude = 2.3 to 2.5 mm,
d) Acceleration = 3G (29.4 m/s^2), and
e) Duration of vibration = 2 h.

9.3.8.1 *Requirement*

There shall be no abnormality or sudden drop in voltage or spillage of electrolyte exhibited by the battery during the test.

NOTE — In the absence of suitable test facilities to carry out the vibration test as specified above and providing that purchaser agrees, the vibration test can be carried out as specified.

9.3.8.1.1 The test shall be performed in accordance with IS 9000 (Part 8) : 1981. The samples shall be first tested for capacity test at 20-h rate before putting into vibration test. The test consists in vibrating the batteries at a frequency of 16 Hz with a total displacement of 5 mm for a period of 2 h. During vibration the batteries shall be discharged at the 20-h rate.

9.3.9 *Overcharge Endurance*

The overcharge endurance test is conducted on a battery which has passed the test of 9.3.4 and 9.3.5 and has been fully charged.

a) Throughout the test the battery shall be kept at an ambient temperature (in a water bath or environmental test chamber of 40 to 45°C).
b) The battery shall be charged at the appropriate current given in Table 6 for a period of 110 h.
c) The battery is then allowed to stand for 48 h on open circuit after (b).
d) At the end of the open circuit stand (c), the battery is discharged at the appropriate current in Table 6, Sl No. (ii) for 30 s.
e) The procedure (b), (c) and (d) constitute one overcharge endurance cycle. Immediately after (d), the battery shall be subjected to the next cycle of overcharge without recharging.
f) When the terminal voltage of the battery reaches down to 7.20 V before 30 s in the test (d), the overcharge endurance test is terminated and the battery is deemed to have reached the end of its overcharge endurance.
g) During the test the battery shall be periodically topped up with pure water to maintain the correct electrolyte level.

9.3.9.1 *Requirement*

The battery shall meet the number of overcharge endurance cycles specified in Table 4, the number excluding the last cycle in which the discharge duration was less than 30 seconds.

9.3.10 *Strength of Terminal*

The strength of terminal is tested by fitting suitable adoptors to the positive and negative terminals (*see* Fig. 4), and applying a torque to the adopter by means of a torque wrench in the direction of rotation illustrated in Fig. 5.

The torque applied shall be as follows:

a) 11.8 Nm for small terminals (Table 1),
b) 14.7 Nm for standard terminals (Table 1)

Table 5 Life Cycle Test

(*Clause* 9.3.7)

Sl. No	Requirement	Battery Type		
		High Current	Medium Current	Low Current
		IN 100, INS 120 IN 120, INT 200 IN 150, IN 180 IN 200	INT 60, IN S60 IN 50, IN 50Z IN 70, IN 70Z	INS 40
(1)	(2)	(3)	(4)	(5)
i)	Discharge at 1 h at current	40 A	20 A	10 A
ii)	Charge for 5 h at current	10 A	5 A	2.5 A

NOTE — Each discharge and charge make one cycle.

9.3.10.1 *Requirement*

The battery terminals shall withstand the torque applied without breaking off or exhibiting any abnormality.

NOTE — This test is optional and shall be carried out only if specifically asked for by the purchaser.

9.3.11 *Robustness to Fastening*

The robustness to fastening is tested under the following conditions:

a) Fastening is made at ambient temperature,

b) During the test the temperature shall be kept between 60 to 65°C, and

c) The duration of test is 5 h after fastening. During this period and after test the state of the battery is examined.

The battery is fastened vertically, diagonally or horizontally in accordance with the method given in Table 7. The individual fastening procedures are illustrated in Fig. 6, 7 and 8.

9.3.11.1 *Requirement*

There shall be no visual deformation in the battery during the test.

NOTE — This test is optional and shall be carried out only if specifically asked for by the purchaser.

Table 6 Overcharge Endurance Test

(*Clause* 9.3.9)

Sl No.	Requirements	Battery Type		
		High Current IN 100, INS 120 IN 120, INT 200 IN 150, IN 180 IN 200	Medium Current INT 60, IN 60 IN 50, IN 50Z IN 70, IN 70Z	Low Current INS 40
(1)	(2)	(3)	(4)	(5)
i)	Charging current (110 h)	9 A	4.5 A	2.25 A
ii)	Discharge test current to 7.20 V	250 A	150 A	75 A

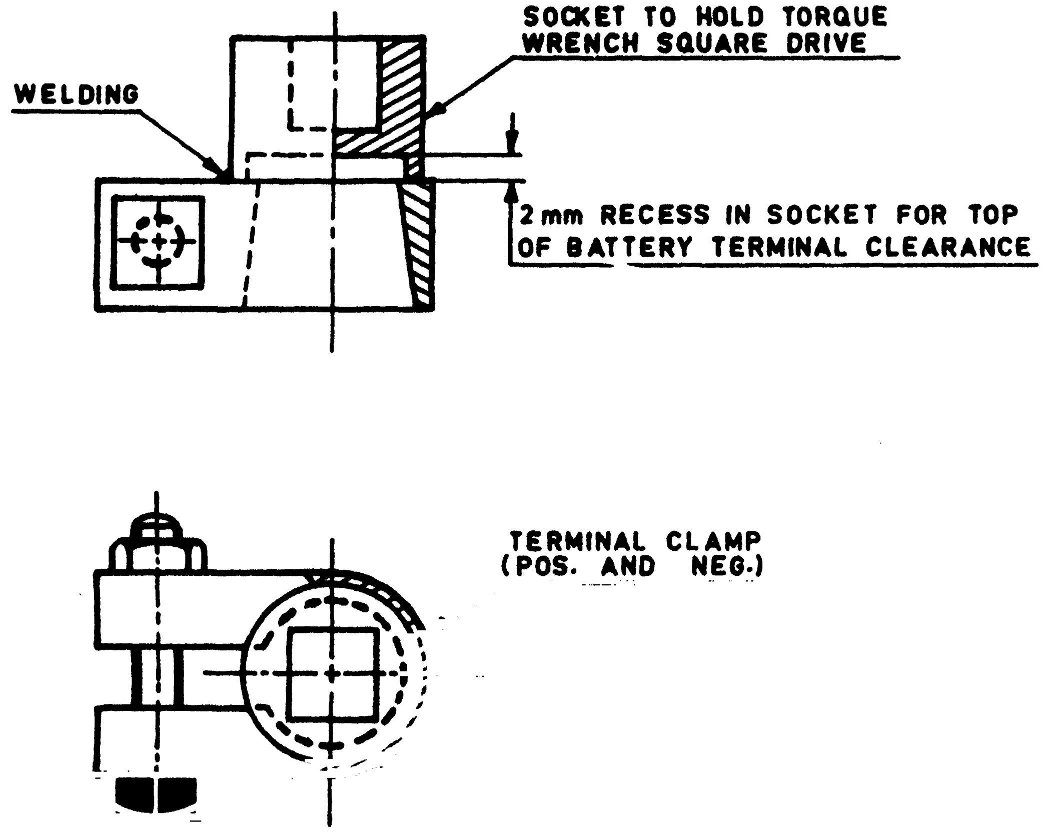

SOCKET TO HOLD TORQUE WRENCH SQUARE DRIVE
WELDING
2 mm RECESS IN SOCKET FOR TOP OF BATTERY TERMINAL CLEARANCE
TERMINAL CLAMP (POS. AND NEG.)

FIG. 4 ADOPTATION FOR STRENGTH OF TERMINAL

Table 7 Fastening Condition

(*Clause* 9.3.11)

Battery Type (1)	Fastening Method (2)	Fastening Load per One Bolt (3)
INS 40, INS 60 IN 50, INT 60 IN 70, IN 50 Z IN 70 Z	Vertical or Horizontal	980 N
IN 100, INS 120 IN 120, INT 200 INI 150, IN 180 IN 200	Diagonal or Horizontal	1 960 N

9.3.12 *Test for Dry-Charged Battery*

9.3.12.1 The battery shall be tested within 60 days of manufacture.

9.3.12.2 The battery shall be maintained at a temperature of 27 ± 2°C for 24 h prior to test.

9.3.12.3 The battery shall then be filled with electrolyte of specific gravity 1.280 ± 0.01. The temperature of the electrolyte before filling shall be 27 ± 2°C.

9.3.12.4 20 min after the completion of filling, the battery shall be discharged at a constant current I = 0.2 C5 until the terminal voltage has fallen to 10.5 V. Readings during the discharge and the calculation of capacity shall be noted as 9.3.4.

9.3.12.5 *Requirements*

The battery shall give not less than 80 percent of its rated 5 h capacity.

NOTE — This test is applicable to those batteries which have been declared as 'dry-charged' by the manufacturer.

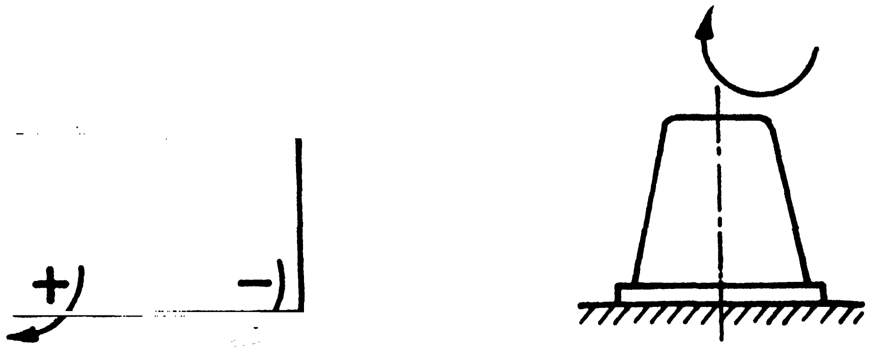


FIG. 5 DIRECTION OF ROTATION

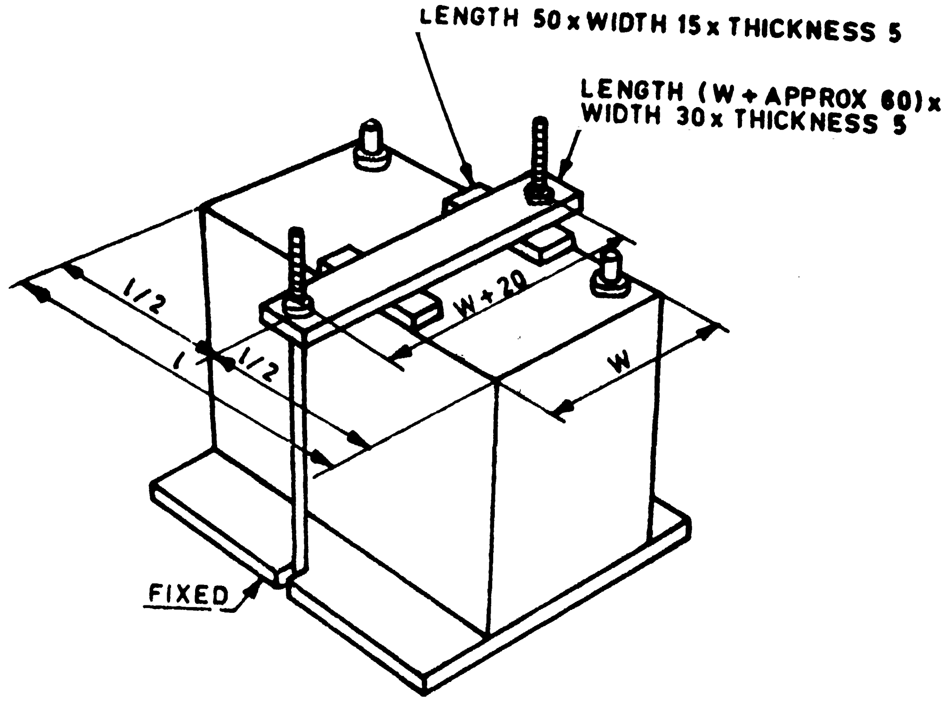

LENGTH 50 x WIDTH 15 x THICKNESS 5
LENGTH (W + APPROX 60) x WIDTH 30 x THICKNESS 5
l/2
l
l/2
W+20
W
FIXED

FIG. 6 VERTICAL FASTENING

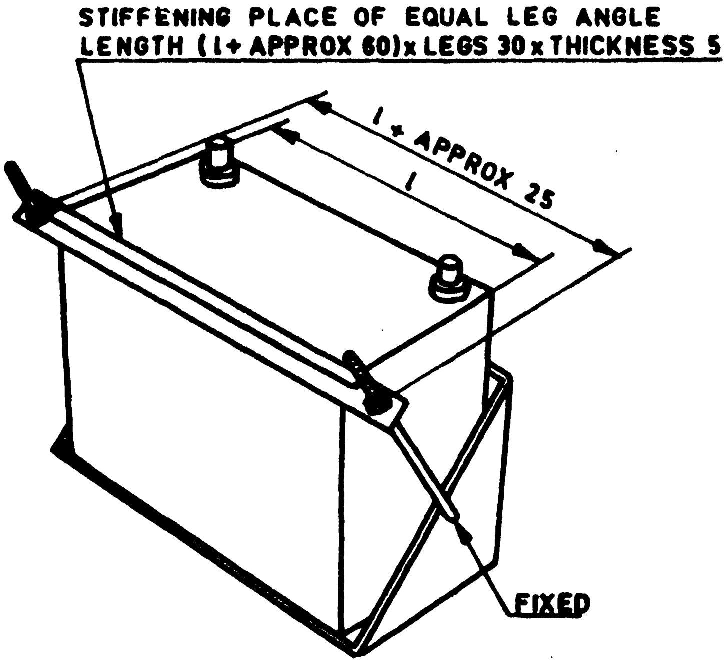

STIFFENING PLACE OF EQUAL LEG ANGLE
LENGTH (l + APPROX 60) x LEGS 30 x THICKNESS 5
l + APPROX 25
l
FIXED

Fig. 7 Diagonal Fastening

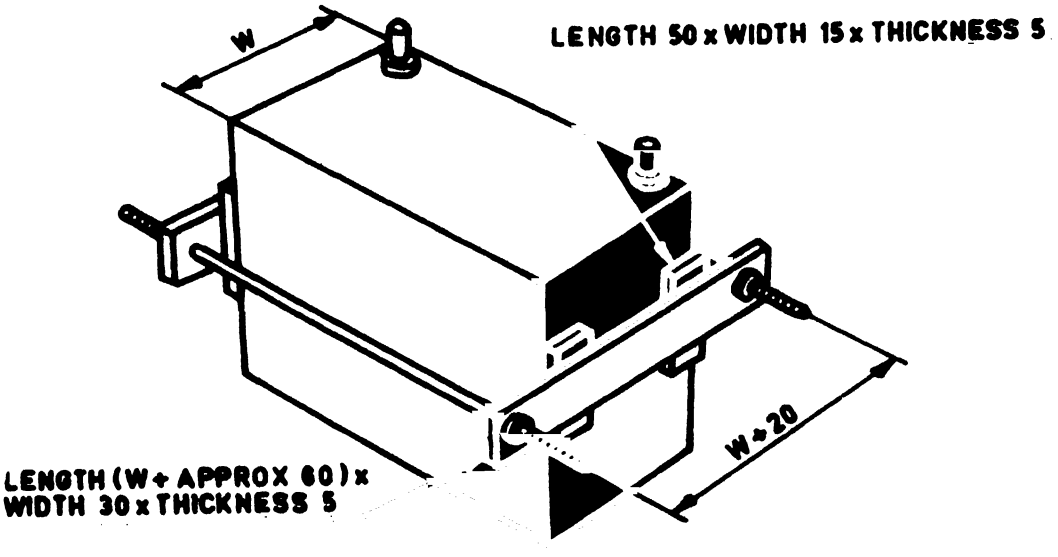


Fig. 8 Horizontal Fastening

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
266 : 1977	Sulphuric acid (*second revision*)
1069 : 1964	Water for storage batteries (*revised*)
1146 : 1981	Rubber and plastic containers for lead-acid storage batteries (*second revision*)
1248 (Part 2) : 1983	Direct acting indicating analogue electrical measuring instruments and their accessories: Part 2 Ammeters and voltmeters (*second revision*)
1885 (Part 8) : 1986	Electrotechnical vocabulary : Part 8 Secondary cells and batteries (*first revision*)
4905 : 1968	Methods for random sampling
6071 : 1986	Synthetic separators for lead-acid batteries (*first revision*)
9000 (Part 8) : 1981	Basic environmental testing procedures for electronic and electrical items: Part 8 Vibration (sinusoidal) test

ANNEX B

(*Clause* 9.1.1.1)

SPECIAL TESTS

B-1 If the contract between manufacturer and customer specifically calls for, the following special tests may be conducted:

1) Reserve capacity (**B-1.1**),
2) Cold cranking performance (CCA) (**B-1.2**).

B-1.1 Reserve Capacity

The reserve capacity is the period of time indicated by the manufacturer in minutes for which a fully charged battery can maintain a discharge current of 25 A to a cut-off voltage of 10.5 V at a temperature of 25 ± 2°C.

Reserve capacity test may be conducted on a battery which has passed the tests under **9.3.4** and **9.3.5**. The test conditions to be maintained are those given under the clause **9.3.4** (a), (b), (d) and (e).

B-1.2 Cold Cranking Performance

The cold cranking performance is the discharge current in amperes, to be declared by the manufacturer, which a battery can deliver at −18°C depending upon any one of the criteria defined below:

i) For 60 s to a cut-off voltage of 8.4 V.
ii) For 30 s to a cut-off voltage of 9.0 V.

Cold cranking amperes conforming to any one of the above criteria may be declared by the manufacturer depending upon customer's choice.

The cold cranking at −18°C may be conducted on a battery which has passed the requirements under **9.3.4** and **9.3.5**. The battery under test shall comply with the following conditions:

a) The fully charged battery shall stand for stabilization for a minimum period of 20 h.
b) Temperature of electrolyte at start of discharge shall be −18 ± 1°C.
c) The battery shall be discharged at the current specified by the manufacturer against its type. During discharge the terminal voltage shall be recorded after every 15 s.

ANNEX C

(*Clause* 9.1.3)

SAMPLING SCHEME AND CRITERIA FOR ACCEPTANCE

C-1 LOT

All the batteries of the same type, design and rating, manufactured by the same factory during the same period using the same process and materials offered for inspection at a time shall constitute a lot.

C-2 SCALE OF SAMPLING

The number of batteries to be selected at random from the lot shall be in accordance with col 1 and 2 of Table 8.

In order to ensure the randomness for selection random number tables shall be used (*see* IS 4905 : 1968).

The batteries selected shall be subjected to the acceptance tests in the order specified in **9.1.2.**

Each of the battery selected in the first stage in accordance with col 2 of Table 8 shall be tested for acceptance. A battery shall be declared defective if it fails in one or more of the acceptance tests. If the number of defects is less than or equal to C1 the lot shall be considered as conforming to the requirements of the standard. If the number of defectives is equal to or less than C2 and greater than C1, a further sample of same size as taken in the first stage shall be taken and tested. If the number of defectives in the two samples combined is less than C3 the lot shall be considered as conforming to the requirements of this standard otherwise the lot shall be considered as not conforming to the requirements of the standard.

Table 8 Sample Size and Criterion for Conformity

(*Clause* C-2)

Lot Size *N*	First Stage *n*	Second Stage *n*	2n	C1	C2	C3
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Up to 50	2	2	4	0	1	1
51 to 300	3	3	6	0	1	1
301 to 500	5	5	10	0	2	2
501 to 1 000	8	8	16	0	2	2
1 001 and above	13	13	26	0	3	4

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